WHAT IS CLAIMED IS:

1. A microfluidic device for capacitive pressure sensing, the device comprising:

a fluid channel including an inlet at a first end and an outlet at a second end;

a cavity region coupled to the fluid channel;

a polymer based membrane coupled between the fluid channel and the cavity region;

a first capacitor electrode coupled to the membrane;

a second capacitor electrode coupled to the cavity region and physically separated from the first capacitor electrode by at least the cavity region;

an electrical power source coupled between the first capacitor electrode and the second capacitor electrode and causing an electric field at least within the cavity region;

wherein the polymer based membrane includes a polymer.

2. The device of claim 1 wherein the polymer comprises a material selected from a group consisting of Parylene, polyimide, and silicone.

3. The device of claim 2 wherein the polymer comprises Parylene.

4. The device of claim 1 wherein the first capacitor electrode is embedded within the polymer based membrane.

5. The device of claim 1, and further comprising:

a substrate, the second capacitor electrode being disposed on the substrate.

6. The device of claim 5 wherein the substrate comprises a material selected from silicon and glass.

7. The device of claim 5, and further comprising:

a layer of silicon oxide, the layer of silicon oxide being disposed between the second capacitor electrode and the substrate.

8. The device of claim 1 wherein the fluid channel contains at least a liquid.

9. The device of claim 1 wherein the fluid channel contains at least a gas.

10. The device of claim 1 wherein the cavity region contains at least a gas.

11. The device of claim 1 wherein the cavity region contains at least a liquid.

12. The device of claim 1 wherein each of the first capacitor electrode and the second capacitor electrode comprises a material selected from a group consisting of gold, aluminum, platinum, chrome, titanium, and doped polysilicon.

13. The device of claim 1 wherein the fluid channel is associated with a fluid pressure;

wherein the fluid pressure is associated with a first shape of the polymer based membrane;

wherein the first shape is associated with a capacitance of a capacitor including the first capacitor electrode, the second capacitor electrode and the cavity region.

14. The device of claim 1 wherein the fluid channels is characterized by a channel height ranging from 0.1 to 100 microns.

15. The device of claim 14 wherein the channel height ranges from 1 to 10 microns.

16. The device of claim 1 wherein the polymer based membrane is characterized by a membrane thickness ranging from 0.1 to 10 microns.

17. The device of claim 16 wherein the membrane thickness ranges from 1 to 5 microns.

18. The device of claim 1 wherein the polymer based membrane is characterized by a membrane diameter ranging from 10 to 1000 microns.

19. The device of claim 18 wherein the membrane diameter is equal to 200 microns.

20. A microfluidic device for capacitive fluidic sensing, the device comprising:

a fluid channel including an inlet at a first end and an outlet at a second end, the fluid channel being associated with a first polymer based layer and a second polymer based layer;

a first capacitor electrode coupled to the first polymer based layer;

a second capacitor electrode coupled to the second polymer based layer and physically separated from the first capacitor electrode by at least the fluid channel;

an electrical power source coupled between the first capacitor electrode and the second capacitor electrode and causing an electric field at least within the fluid channel;

wherein the first polymer based layer includes a first polymer;

wherein the second polymer based layer includes a second polymer.

21. The device of claim 20 wherein each of the first polymer and the second polymer comprises a material selected from a group consisting of Parylene, polyimide, and silicone.

22. The device of claim 21 wherein each of the first polymer and the second polymer comprises Parylene.

23. The device of claim 20, and further comprising:

a substrate, the second capacitor electrode being disposed on the substrate.

24. The device of claim 23 wherein the substrate comprises a material selected from silicon and glass.

25. The device of claim 23, and further comprising:

a layer of silicon oxide, the layer of silicon oxide being disposed between the second capacitor electrode and the substrate.

26. The device of claim 20 wherein the fluid channel contains at least a liquid.

27. The device of claim 20 wherein the fluid channel contains at least a gas.

28. The device of claim 20 wherein each of the first capacitor electrode and the second capacitor electrode comprises a material selected from a group consisting of gold, aluminum, platinum, chrome, titanium, and doped polysilicon.

29. The device of claim 20 wherein the fluid channels is characterized by a channel height ranging from 0.1 to 100 microns.

30. The device of claim 29 wherein the channel height is ranging from 1 to 10 microns.

31. The device of claim 20 wherein the fluid channels is characterized by a channel width ranging from 1 to 1000 microns.

32. The device of claim 31 wherein the channel width is equal to 100 microns.

33. The device of claim 20 wherein

the fluid channel is associated with a fluid volume;

the fluid volume is associated with a capacitance of a capacitor including the first capacitor electrode, the second capacitor and the fluid channel.

34. The device of claim 20 wherein

the fluid channel is associated with a fluid;

the fluid is associated with a capacitance of a capacitor including the first capacitor electrode, the second capacitor and the fluid channel;

the capacitance is associated with at least a characteristic of the fluid.

35. The device of claim 34 wherein the characteristic of the fluid is a dielectric constant.

36. The device of claim 34 wherein the characteristic of the fluid is a conductivity.

37. The device of claim 34 wherein the fluid comprises a mixture of a plurality of solvents.

38. The device of claim 37 wherein the mixture comprises at least one solvent selected from a group consisting of water, IPA, acetonitrile, acetone, methanol, and ethanol.

39. The device of claim 34 wherein the characteristic of the fluid is a composition of the fluid.

40. A microfluidic device for capacitive fluidic sensing, the device comprising:

a fluid channel including an inlet at a first end and an outlet at a second end, the fluid channel being associated with a first polymer based layer and a second polymer based layer;

a first capacitor electrode coupled to the first polymer based layer;

a second capacitor electrode coupled to the first polymer based layer and physically separated from the first capacitor electrode;

an electrical power source coupled between the first capacitor electrode and the second capacitor electrode and causing an electric field at least within the fluid channel;

wherein the first polymer based layer includes a first polymer;

wherein the second polymer based layer includes a second polymer.

41. The device of claim 40 wherein each of the first polymer and the second polymer comprises a material selected from a group consisting of Parylene, polyimide, and silicone.

42. The device of claim 41 wherein each of the first polymer and the second polymer comprises Parylene.

43. The device of claim 40, and further comprising:

a substrate, the first capacitor electrode and the second capacitor electrode being disposed on the substrate.

44. The device of claim 43 wherein the substrate comprises a material selected from silicon and glass.

45. The device of claim 43, and further comprising:

a layer of silicon oxide, the layer of silicon oxide being disposed between the second capacitor electrode and the substrate.

46. The device of claim 40 wherein the fluid channel contains at least a liquid.

47. The device of claim 40 wherein the fluid channel contains at least a gas.

48. The device of claim 40 wherein each of the first capacitor electrode and the second capacitor electrode comprises a material selected from a group consisting of gold, aluminum, platinum, chrome, titanium, and doped polysilicon.

49. The device of claim 40 wherein the fluid channels is characterized by a channel height ranging from 0.1 to 100 microns.

50. The device of claim 49 wherein the channel height ranges from 1 to 10 microns.

51. The device of claim 40 wherein the fluid channels is characterized by a channel width ranging from 1 to 1000 microns.

52. The device of claim 51 wherein the channel width is equal to 100 microns.

53. The device of claim 40 wherein the first capacitor electrode and the second capacitor electrode are interlocking.

54. The device of claim 40 wherein each of the first polymer layer and the second polymer based layer is characterized by a thickness ranging form 0.1 to 10 microns.

55. The device of claim 40 wherein

the fluid channel is associated with a fluid volume;

the fluid volume is associated with a capacitance of a capacitor including the first capacitor electrode, the second capacitor and the fluid channel;

the capacitance is associated with a volume resolution smaller than 5 pL.

56. The device of claim 40 wherein

the fluid channel is associated with a fluid;

the fluid is associated with a capacitance of a capacitor including the first capacitor electrode, the second capacitor and the fluid channel;

the capacitance is associated with at least a characteristic of the fluid.

57. The device of claim 56 wherein the characteristic of the fluid is a dielectric constant.

58. The device of claim 56 wherein the characteristic of the fluid is a conductivity.

59. The device of claim 56 wherein the fluid comprises a mixture of a plurality of solvents.

60. The device of claim 59 wherein the mixture comprises at least one solvent selected from a group consisting of water, IPA, acetonitrile, acetone, methanol, and ethanol.

61. The device of claim 56 wherein the characteristic of the fluid is a composition of the fluid.

62. The device of claim 40 wherein the first capacitor electrode and the second capacitor electrode are configured as parallel plates.

63. A method for fabricating a capacitive fluidic sensing device, the method comprising:

providing a substrate;

patterning a first electrode layer to form at least a first electrode overlying the substrate;

forming a first polymer based layer overlying the first electrode;

forming a first sacrificial layer overlying the first polymer based layer;

forming a second polymer based layer overlying the first sacrificial layer;

patterning a second electrode layer to form at least a second electrode over the second polymer based layer, the second electrode being associated with the first electrode;

forming a third polymer based layer overlying the second electrode to sandwich the second electrode between the second polymer based layer and the third polymer based layer;

forming a second sacrificial layer overlying the third polymer based layer;

forming a fourth polymer based layer overlying the second sacrificial layer;

releasing the first sacrificial layer between the first polymer based layer and the second polymer based layer; and

releasing the second sacrificial layer between the second polymer based layer and the third polymer based layer.

64. The method of claim 63 wherein:

the first polymer based layer, the second polymer based layer, the third polymer based layer, and the fourth polymer based layer are formed at a temperature of less than 120°C; and

the first sacrificial layer and the second sacrificial layer are formed and released at a temperature of less than 120°C.

65. The method of claim 63 wherein the first polymer based layer, the second polymer based layer, the third polymer based layer, and the fourth polymer based layer are provided at room temperature using chemical vapor deposition of Parylene.

66. A method for fabricating a capacitive fluidic sensing device, the method comprising:

providing a substrate;

patterning a first electrode layer to form at least a first electrode overlying the substrate;

forming a first polymer based layer overlying the first electrode;

forming a first sacrificial layer overlying the first polymer based layer;

forming a second polymer based layer overlying the first sacrificial layer;

patterning a second electrode layer to form at least a second electrode over the second polymer based layer, the second electrode being associated with the first electrode;

forming a third polymer based layer overlying the second electrode to sandwich the second electrode between the second polymer based layer and the third polymer based layer;

releasing the first sacrificial layer between the first polymer based layer and the second polymer based layer.

67. The method of claim 66 wherein:

the first polymer based layer, the second polymer based layer, and the third polymer based layer are formed at a temperature of less than 120°C; and

the first sacrificial layer is formed and released at a temperature of less than 120°C.

68. The method of claim 66 wherein the first polymer based layer, the second polymer based layer, and third polymer based layer are provided at room temperature using chemical vapor deposition of Parylene.

69. A method for fabricating a capacitive fluidic sensing device, the method comprising:

providing a substrate;

patterning a first electrode layer to form at least a first electrode and a second electrode overlying the substrate, the second electrode being associated with the first electrode;

forming a first polymer based layer overlying the first electrode and the second electrode;

forming a first sacrificial layer overlying the first polymer based layer;

forming a second polymer based layer overlying the first sacrificial layer;

releasing the first sacrificial layer between the first polymer based layer and the second polymer based layer;

wherein the first electrode and the second electrode are two interlocking and physically separated electrodes.

70. The method of claim 69 wherein:

the first polymer based layer and the second polymer based layer are formed at a temperature of less than 120°C; and

the first sacrificial layer is formed and released at a temperature of less than 120°C.

71. The method of claim 69 wherein the first polymer based layer and the second polymer based layer are provided at room temperature using chemical vapor deposition of Parylene.

72. The device of claim 40 wherein

the first capacitor electrode includes a first plurality of electrode elements;

the second capacitor electrode includes a second plurality of electrode elements;

each of the first plurality of electrode elements and the second plurality of electrode elements is associated with a width ranging from 1 to 100 microns.

73. The device of claim 40 wherein

the first capacitor electrode includes a first electrode element;

the second capacitor electrode includes a second electrode element;

the first electrode element is adjacent to the second electrode element;

the first electrode element is physically separated from the second electrode element by a spacing distance;

the spacing distance ranges from 1 to 100 microns.